

# NRC INSPECTION MANUAL

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## INSPECTION PROCEDURE 49053

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### REACTOR COOLANT PRESSURE BOUNDARY PIPING - WORK OBSERVATION

PROGRAM APPLICABILITY: 2512

#### 49053-01 INSPECTION OBJECTIVES

01.01 By direct observation and independent evaluation of work performance, work in progress, and completed work, determine whether activities relative to reactor coolant pressure boundary piping, except welding and NDE activities, are being accomplished in accordance with NRC requirements, SAR commitments, and licensee procedures.

01.02 Determine whether completed work, partially completed work, or work activities in progress associated with reactor coolant pressure boundary piping indicate management control problem or generic weakness.

#### Inspection Schedule

<u>Inspection</u>	<u>May Be Started</u>	<u>Must Be Started</u>	<u>Must Be Completed</u>
First	After work is 10% complete	Before work is 20% complete	Before work is 30% complete
Second	After work is 50% complete	Before work is 60% complete	Before work is 80% complete
Semiannual	-----	Optional	-----

#### 49053-02 INSPECTION REQUIREMENTS

02.01 In four systems listed in Section 03 of this procedure, observe portions of five different piping activities such as: handling; protection; installation of pipe spools, fittings, and bellows; cutting; grinding; bending; supporting; cleaning and flushing; and quality-related inspections. (Inspections are to be performed at least twice during the construction phase.)

02.02 Semiannually, in one system listed in Section 03 of this procedure, observe five different piping installation activities such as handling; protection; installation of pipe spools, fittings, and bellows; cutting; grinding; bending; heat treatments; cleaning and flushing; supporting; and quality-related inspections.

02.03 Ascertain whether the following activities and/or requirements for the activities selected above, meet applicable requirements and established procedures:

- a. inspection (QC) and/or work performance verification, including specified frequency of inspections
- b. record keeping
- c. construction and installation
- d. issuance and use of specified materials
- e. utilization of qualified inspection personnel
- f. control of nonconforming items

02.04 For two locations or "runs" between major components within the reactor coolant pressure boundary, where piping installation has been completed or essentially completed, ascertain whether the runs are installed as specified.

02.05 For second inspection (where piping is essentially complete) select six as-built/final design reactor coolant loop piping drawings and compare portions of these drawings with the actual installation. Discrepancies observed may result from in-process changes such as those initiated by the design organization or those initiated in the field. If in-process changes are involved, determine whether the licensee has properly controlled and documented these changes on a current basis for engineering review, approval, subsequent incorporation into final as-built drawings, and a revised stress analysis, as appropriate.

02.06 Expand the sample size, as appropriate, to include additional systems listed in Section 03. Complete selected portions of Sections 02.01, 02.02, 02.03, 02.04, 02.05, and 02.06.

02.07 Additional inspections, as determined by regional management may be conducted in the areas covered above when the licensee's performance is classified as Category 3 by the SALP program or if regional management concludes that recent findings will likely result in a SALP Category 3 rating. In these cases, particular consideration should be given to an expanded sample of items to be inspected under Sections 02.01, 02.02, 02.03, 02.04, 02.05, and 02.06.

## 49053-03 INSPECTION GUIDANCE

### General Guidance

- a. Because of the importance and extent of reactor coolant pressure boundary piping, observation of work activities in this area is conducted at least twice. The intent of this procedure is to accomplish the inspection requirements of Section 02 when piping activities in this area are about one-third and two-thirds complete.
- b. Before observing the activities selected in Section 02, review the pertinent SAR chapters as well as related specifications, drawings, and procedures. For example, before inspecting materials and components in storage, determine the requirements for such things as storage conditions, protection from damage, special preservation, material and component identification, segregation of nonconforming items, and required records.

- c. The inspector may not be able to observe all facets of all work activities in progress relative to piping activities selected in Section 02 of this procedure. However, the direct observation of portions of activities should be made. In some cases, it will be necessary to observe the completed work rather than work in progress. Moreover, it may be more appropriate to observe some piping after installation rather than during installation. The intent is to determine the adequacy of completed work as well as in-process work. The inspector should use judgment in this regard.
- d. Findings from this inspection activity should address each element as being satisfactory, being unresolved and requiring resolution, or being in violation and requiring correction. When significant inadequacies are identified in licensee/contractor activities, the inspector should inform cognizant regional supervision. The issue should be addressed at the appropriate level of licensee management.
- e. The reactor coolant pressure boundary for a BWR includes all systems that tie directly into the reactor pressure vessel out to and including the second isolation valve. The reactor coolant pressure boundary for a PWR includes the primary coolant system piping and those branch connections out to and including the second isolation valve. [Reference 10 CFR 50.2(v).]
- f. This procedure pertains to all reactor coolant pressure boundary piping activities at the site except welding and nondestructive examination (i.e., receipt inspection, identification, storage, handling, protection, installation, inspection, and documentation).

#### 03.01 Specific Guidance

- a. Inspection Requirement 02.03a. The intent is to determine whether piping is installed and inspected in accordance with applicable specifications, drawings, and procedures.
- b. Inspection Requirement 02.03c. This should include verification that pipe-to-pipe and interdisciplinary clearance requirements are met.
- c. Inspection Requirement 02.03e. Inspection personnel should be qualified for the work they are doing and they should be performing their assigned duties.
- d. Inspection Requirement 02.05. The intent is to determine whether safety-related piping is being installed according to properly approved drawings—either the original design drawings or properly approved revisions or other design change documents. If revisions are in process, determine that these changes are properly handled in accordance with established procedures.

Appropriate standards can be used as a guide in this area. For example, ANSI N45.2.11 requires that where changes to previously verified designs have been made, design verification shall be required for the changes, including evaluation of the effects of those changes on the overall design. Further, N45.2 states that records correctly identifying the as-built conditions of items in the nuclear facility shall be maintained and stored for the life of the particular item while it is installed in the nuclear facility. In addition, 10 CFR 50, Appendix B, Criterion III, states, in part, that design and field changes shall be subject to the same design control procedures as the original design. Numerous changes may be made to reactor coolant pressure boundary piping during construction that are different from the original (SAR) design. Such changes will result in the accumulation of various types of design change documents and/or marked-up drawings. Since these changes reflect as-built conditions, they should be adequately controlled so they

will be readily available for use with affected original design documents during future evaluations on the effect other design changes have on the overall design and final stress analysis. In addition, the as-built process should result in proper and timely updating of the original/master drawings and specifications to incorporate such changes.

03.02 Prevalent Errors/Concerns. This section is included to provide background on past piping problems of a generic nature that have been identified and where certain areas should be more closely scrutinized to give NRC early information on potential problems. These areas include:

- a. Stability of the work force or QA/QC personnel, attitudes in work crews, and relations between construction personnel and QA/QC personnel.
- b. Power grinders used for weld preparation of pipe (socket welds) that result in violation of minimum wall thickness.
- c. Piping runs containing mud, sand, and foreign material.
- d. Incorrectly sized orifices installed in pump recirculation lines.
- e. Surfaces for welding not properly free of paint, oil, rust, or other material that is detrimental to welding.
- f. Drawings or other records fail to show evidence of actual piping components installed in pipeline or are not a current revision.
- g. Piping changes without proper design change authorization.
- h. Repairs of linear indications on pipe spool pieces not properly performed as to testing for wall thickness and blending uniformly into the surrounding surfaces.
- i. Controls over the installation/removal of cleaning and flushing devices are inadequate.
- j. Problems regarding as-builts as referenced in IE Bulletin 79-14.

Piping systems in the reactor coolant pressure boundary include but are not necessarily limited to the following:

## BWR Systems

Recirculation  
Core spray  
Control rod drive  
Feedwater  
Main steam  
Standby liquid control  
Reactor water cleanup  
Reactor core isolation  
cooling  
High-pressure coolant  
injection  
Residual heat removal  
Safety and relief valves  
Reactor coolant vent and drain  
Instrument piping

## PWR Systems

Primary coolant  
Chemical and volume control  
High-pressure safety injection  
Low-pressure safety injection  
Accumulators (safety injection)  
Residual heat removal  
Safety and relief Valves  
Reactor coolant vent and drain  
Pressurizer surge line  
Instrument Piping

Where selections are involved during inspection activities, do not establish a "pattern" so that the licensee or contractor can expect only certain activities or components to be inspected. Selection of activities should provide for diversification of piping systems.

## 49053-04 REFERENCES

SAR, Chapters 1, 3, 5, 7 and 17, including pertinent codes and standards referenced in these chapters.

Regulatory Guide 1.116, "Quality Assurance Requirements for Installation; Inspection and Testing of Mechanical Equipment and Systems"

Regulatory Guide 1.26, "Quality Group Classification"

Regulatory Guide 1.28, "Quality Assurance Program Requirements (Design and Construction)"

Regulatory Guide 1.37, "Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-Cooled Nuclear Power Plants"

Regulatory Guide 1.38, "Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Water-Cooled Nuclear Power Plants"

Regulatory Guide 1.58, "Qualification of Nuclear Power Plant Inspection Examination, and Testing Personnel"

Regulatory Guide 1.88, "Collection, Storage, and Maintenance of Nuclear Power Plant Quality Assurance Records"

American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section III

ANSI N45.2.1, "Cleaning of Fluid Systems"

ANSI N45.2.6, "Qualifications for Inspection, Examination and Testing Personnel"

ANSI N45.2.8, "Quality Assurance - Mechanical Equipment & System Installation"

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